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ANIMAL INVESTIGATION PROGRAM
1969 ANNUAL REPORT

by
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ABSTRACT

This report presents the radionuclide content of selected bovine, deer, and Bighorn sheep tissues which were collected during 1969 from animals grazing on or near the Nevada Test Site. The radionuclide burden remains low, with the highest levels and widest range reported from animals collected in May. The strontium content of bones collected from all three species continues the downward trend of recent years.

Other activities of the Animal Investigation Program during 1969 are also mentioned.

ACKNOWLEDGMENT

The authors wish to express their thanks to Dr. James N. Shively, Division of Biological Effects, Bureau of Radiological Health, 12720 Twinbrook Parkway, Rockville, Maryland. Dr. Shively performed the histopathological analysis of the tissue samples collected during this reporting period.

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INTRODUCTION

The major objectives of the Animal Investigation Program (AIP) are:

1. To determine tissue concentrations of fresh and/or aged fission and activation products in biological samples obtained from bovine on the Nevada Test Site (NTS) and from off-site ranches, if required.
2. To develop and conduct wildlife studies or and near the Nevada Test Site in cooperation with state and federal wildlife agencies in order to assess radionuclide content of various edible wildlife species.
3. To maintain veterinary relations with the off-site population.
4. To investigate alleged damage to domestic animals from the Atomic Energy Commission's (AEC) activities.

This report is intended to detail the analytical results reported and progress made in meeting the above objectives in 1969.

THE NTS BEEF HERD

The Atomic Energy Commission's beef herd was maintained in Area 18 the entire year, except for the two herd sires that were placed in the herd for overlapping periods of two months during the summer. Details of animal husbandry and herd history were described previously.(1)

As of the end of 1969, the herd consisted of 89 animals as follows: 2 bulls, 19 aged cows (4 years and older), 7 three-year-old cows, 8 two-year-old heifers, 6 two-year-old steers, 12 yearling heifers, 11 yearling steers, 12 (1969) heifer calves, and 12 (1969) steer calves. The 1969 calving percentage was 96% and the average rate of gain of the calves was 1.5 pounds per day for the 146-day period between May 22 and October 16.

As part of the surveillance activities, six bovine from the herd are sacrificed semiannually and selected tissues are collected for radioanalysis and histopathological examination. These sacrifices took place on May 7 and October 16. The vital statistics of the sacrificed animals are presented in Table 1. Unless otherwise noted, each sacrificed animal spent its entire life grazing on the Area 18 range of the Nevada Test Site.

Each animal is sacrificed by firing a 243 caliber bullet into the brain. Immediately after death the animal is necropsied by a

Table 1. Vital Statistics of Sacrificed Bovine

I.D. Number	Date Sacrificed	Breed	Sex	Age	Wt in kg	Remarks
BOV-1-NTS-69	7 May 1969	Hereford	Steer	3 yrs	377	
BOV-2-NTS-69	7 May 1969	Hereford	Steer	3 yrs	432	
BOV-3-NTS-69	7 May 1969	Hereford	Steer	2 yrs	323	
BOV-4-NTS-69	7 May 1969	Hereford	Steer	2 yrs	422	
BOV-5-NTS-69	7 May 1969	Hereford	Bull	1 mo	57	Calf of BOV-6-NTS-69.
BOV-6-NTS-69	7 May 196º	Hereford	Cow	10 yrs	384	Dam of BOV-5-NTS-69. Prior to 1965 grazed on Yucca Flat.
BOV-7-NTS-69	16 Oct 1969	Hereford	Bull	5.5 yrs	738	On Area 18 range 9 Jun-8 Aug 69 and 18 Sep-16 Oct 69.
BOV-8-NTS-69	16 Oct 1969	Holstein	Bull	3.5 yrs	1161	Entire life spent in Area 15 corrals.
BOV-9-NTS-69	16 Oct 1969	Hereford	Steer	1.5 yrs	281	
BOV-10-NTS-69	16 Oct 1969	Hereford	Steer	3.5 yrs	511	
BOV-11-NTS-69	16 Oct 1969	Hereford	Steer	1.5 yrs	409	
BOV-12-NTS-69	16 Oct 1969	Hereford	Steer	1.5 yrs	344	

veterinarian and all pathological conditions are noted. All of the sacrificed animals were in good physical condition and no significant lesions were found. In addition to the necropsy, the adrenals, eyes, heart, kidneys, liver, lungs, muscles, spleen, thyroid, and gonads were sampled for histopathological examination.

Tissue sections were prepared for microscopic evaluation. A summary of the results is presented in Appendix I. No lesions were reported that could be attributable to radiation damage.

Tissues collected for radioanalysis included abomasum contents, abomasum tissue, femur, liver, lung, muscle, rumen contents, and thyroid. Quantitative analysis of the tissues is made for ^{144}Ce, ^{131}I, ^{106}Ru, ^{137}Cs, ^{95}Zr, ^{54}Mn, ^{140}Ba, and K, as determined by the ^{40}K fraction, using the least squares method. The bone was analyzed for ^{89}Sr and ^{90}Sr only.

The summary of the analytical results is presented in Table 2. The minimum detectable limit (MDL) used in this report is based on laboratory findings or on calculations. Analytical procedures used at the Southwestern Radiological Health Laboratory (SWRHL) are described in another publication.(2)

The radionuclide burdens of the various tissues remain low, with the highest levels and greatest variability shown in tissues collected from animals sacrificed in May.

Table 2. Summary of Analytical Results Found in 1969 Bovine Tissues
Unless otherwise noted, results are reported as wet weight of sample.

Tissue	K g/kg	^{89}Sr pCi/g ash	^{90}Sr pCi/g ash	^{106}Ru pCi/g	^{131}I pCi/kg	^{137}Cs pCi/kg	^{144}Ce pCi/g	^{54}Mn pCi/kg
Abomasum Contents	5.6(11)* 0.[illegible]-14.6	NA	NA	2.2(5)† 1.7-2.4	630(2) 410-860	660(6) 300-1300	3.5(7) 1.5-5.0	330(3) 240-420
Abomasum Tissue	1.4(10) 0.8-2.3	NA	NA	1.6(2) 1.4-1.8	All samples <250	All samples <200	All samples <1.3	All samples <200
Bone Femur	NA	All samples <MDL	5.4(12) 3.7-12.6	NA	NA	NA	NA	NA
Liver	2.9(12) 1.7-4.2	NA	NA	All samples <1.3	All samples <250	All samples <200	2.0(2) 1.7-2.3	All samples <200
Lung	2.4(6) 1.7-3.3	NA	NA	2.4(4)† 1.3-2.7	All samples <250	All samples <200	All samples <1.3	All samples <200
Muscle	3.4(12) 2.9-3.8	NA	NA	All samples <1.3	All samples <250	All samples <200	All samples <1.3	All samples <200
Rumen Content	1.4(10) 0.7-3.9	NA	NA	2.2(4)† 1.5-2.8	All samples <250	All samples <200	2.7(2) 1.7-3.8	All samples <200
Thyroid pCi/g	Not Detectable	NA	NA	All samples <1.3	2.0(3)* 0.7-2.7	All samples <0.2	All samples <1.3	All samples <0.2
Thymus BOV-5-NTS-69	5.5±3.2	NA	NA	3.4(1) ±2.5	335(1) ±308	375(1) ±233	Sample <1.3	Sample <200
Milk BOV-6-NTS-69	Not Detectable	NA	NA	Sample <1.3	Sample < 250	Sample <200	Sample <1.3	Sample <200
Testes BOV-7&8-NTS-69	2.1(2) 2.0-2.1	NA	NA	Both samples <1.3	Both samples <250	Both samples <200	Both samples <1.3	Both samples <200

Remarks:
*1st number is average. Number in parenthesis is number of samples above MDL. Other samples collected were below MDL or had insufficient activity for analysis. Third set of numbers is range.

†All ^{106}Ru values reported found in adult animals at spring sacrifice.

**All of these ^{131}I results were found in spring slaughter. The Holstein bull (BOV-8-NTS-69) had 170 pCi/gm at the fall slaughter but had access to contaminated alfalfa green chop.

NA = Not analyzed.

The rumen and abomasum contents showed the highest levels and widest variety of radionuclides detected. However, due to poor biological absorption only a few tissues showed concentrations above the MDL. The only notable exception was ^{106}Ru in the lungs of four of the animals sacrificed in May. This may have resulted from the inhalation of resuspended particles from the depositions of the Buggy, Danny Boy, Little Feller I and Little Feller II events, from the spring activities of the Nuclear Rocket Development Station, or from debris from Project Schooner.

Iodine-131 was detected in the thyroids of three of the adults and the thymus of the calf from the spring sacrifice. However, the levels were less than 3 pCi/g in all cases. The source of the ^{131}I may have been EP III and IV runs of the XE' reactor which was tested on April 17, 1969. The winds at that time were from 180° - 230°.

The Holstein bull sacrificed in October had 170 pCi/g of ^{131}I in the thyroid. This animal had been maintained in a dry lot at Area 15 for his entire life and the ^{131}I probably resulted from the ingestion of fresh alfalfa green chop that was harvested from lands contaminated by the experimental release of gaseous and particulate ^{131}I (Project Retake) on September 9, 1969, or may have been from an event that released detectable activity on the NTS on September 12, 1969.

The only significant difference observed attributable to age was the ^{90}Sr content of the femur bone. The 10-year-old cow had a burden of ^{90}Sr that was over twice that of the younger animals. The cow's burden

was 12.6 pCi/g of ash while the other animals averaged 4.8 pCi/g of ash (range of 3.7 - 5.7 pCi/g of ash). The average ^{90}Sr content of 5.4 pCi/g of ash continues the downward trend of recent years (1968 samples averaged 8.8 pCi/g of ash).

Levels of ^{89}Sr, ^{95}Zr, and ^{140}Ba were below the MDL in all samples. Manganese-54 was detectable only in the ingesta of three animals, and ^{144}Ce was found only in liver samples in addition to the rumen and abomasum contents.

The University of Nevada at Reno and the AIP are engaged in a cooperative four-year study to determine the composition of the diet of the NTS beef animals by utilizing rumen fistulated steers as a biological sampler. Three mature rumen fistulated steers are placed on the Area 18 range once a month and are allowed to graze. The ingested food is then removed from the rumen via the fistula. These samples are then analyzed for radionuclide content, nutritional value, and botanical content. Table 3 summarizes the findings for 1969. The only radionuclides detected in the ingesta were ^{106}Ru and ^{144}Ce and the highest concentrations were found in the first half of the year.

A report summary of all data collected from the fistulated steers will be published following the end of the study in March 1970. This report will be authored by personnel of the University of Nevada, the AIP and the Ecology Section of SWRHL.

Table 3. Analytical Results of Rumen Contents Collected from Fistulated Steers.
Results are reported as wet weight of sample.

Date Steers Sampled	K g/kg	^{106}Ru pCi/g	^{144}Ce pCi/g	Area Steers Grazed	Remarks
23 Jan 69	3.9 ±0.7	< 1.3	3.7 ±0.5	Well 8 canyon	80% of diet perennial grasses. Sitanion hystrix (squirrel tail) was the dominant species.
6 Mar 69	1.5 ±0.6	1.7 ± 0.5	2.0 ±0.4	South of Pahute airport	Slightly more than 80% of the diet consisted of Stipa speciosa (Desert needlegrass) and squirrel tail.
27 Mar 69	4.2 ±0.5	1.5 ± 0.3	< 1.3	South of Pahute airport	Results were similar for both March collections.
24 Apr 69	0.64 ±0.57	< 1.3	< 1.3	Well 8 canyon	98% of diet was Elymus cinereus (Giant wild rye grass).
28 May 69	1.6 ±0.6	1.3 ± 0.5	< 1.3	Well 8 canyon	Elymus cinereus (Giant wild rye) and Bromus tectorium (cheat grass) made up 80% of the diet.
25 Jun 69	3.2 ± 1.0	2.0 ± 0.8	< 1.3	Well 8 canyon	Grasses 70% of diet, Salsola kali (Russian thistle) 20% of diet.
31 Jul 69	3.5 ± 0.8	< 1.3	< 1.3	Well 8 canyon	Russian thistle content of diet increased to more than 50% and grass content dropped to less than 40%.
18 Aug 69	2.4 ± 1.0	1.3 ± 0.7	< 1.3	Well 8 canyon	Russian thistle contributed 86% of the diet.
25 Sep 69	1.7 ± 0.8	< 1.3	< 1.3	Well 8 canyon	Grasses - 50 % of diet. Russian thistle - 10% of diet. Quercus gambelii (Gambel's oak) - 30%.
23 Oct 69	4.0 ± 0.6	< 1.3	< 1.3	Well 8 canyon	Giant wild rye grass - 60% of diet. Rumen contents of sacrificed animals showed 60% was perennial grass species squirrel tail and 35% Russian thistle.
26 Nov 69	1.7 ± 0.5	< 1.3	< 1.3	Well 8 canyon	Two samples revealed different composition. One was 70% shrubs - Ephedra viridis, (Mountain joint fir) and Cowania mexicania (Cliff rose). One was 70% grasses - Orhyzopsis hymenoides (Indian rice grass) and squirrel tail grass.
10 Dec 69	1.6 ± 0.5	< 1.3	< 1.3	Well 8 canyon	75% of diet was Gambel's oak.

WILDLIFE STUDIES

Mule Deer

The AIP, as part of its wildlife studies collects at least one mule deer a quarter from the NTS. These deer were either collected with a 243 caliber rifle under the provisions of scientific collecting permit #69-20, issued to the AIP by the Nevada Fish and Game Commission, or they were collected as the result of a motor vehicle collision. In 1969 it was necessary to collect only two deer by hunting. All others were collected as a result of road kills. (See Table 4 for vital statistics.)

Table 4. Vital Statistics of NTS Mule Deer Collected in 1969

Number	Sex	Estimated Age	Estimated Wt.(kg)	Date Collected	Remarks
MD-2-NTS-69	Male	2 yrs	46	2 May 69	Collected by hunting, 2 miles east of Captain Jack's spring.
MD-3-NTS-69	Male	3 yrs	55	31 Jul 69	Collected by hunting at junction of Holmes and Rainier Mesa Roads. Numerous fibrotic warts on right face and neck.
MD-4-NTS-69	Female	4 yrs	55	12 Oct 69	Road kill at U 19R on Dead Horse Road - Rainier Mesa.
MD-5-NTS-69	Female	3 yrs	46	31 Oct 69	Road kill - 1/2 mile west of Echo Peak Road turnoff on Pahute Mesa.
MD-6-NTS-69	Male	1-1/2 yrs	46	11 Nov 69	Road kill - Rainier Mesa Road - Area 2.

The same samples for histopathology and radionuclide analysis are collected as are collected from the beef cattle with the exception that the bone is taken from the hock joint instead of the femur. Because of the time lapse, histopathologic samples are usually not collected from the accident victims. The results of the histopathological examination are found in Appendix I. Table 5 presents the analytical results.

The analytical results parallel those found in the beef cattle. The deer collected on May 2 had about the same tissue burdens as the beef cow sacrificed on May 7. Its lungs contained ^{106}Ru and its thyroid ^{131}I. Rumen and abomasum contents of both the May and July deer contained detectable levels of ^{106}Ru and ^{144}Ce. The October and November deer showed no detectable levels except for ^{90}Sr in the hock bone. The 1969 average of 6.8 pCi/g of ash is down from that of 1968 (8.8 pCi/g of ash). No samples exceeded the MDL for ^{54}Mn, ^{95}Zr, and ^{140}Ba.

Desert Bighorn Sheep

Personnel of the U. S. Fish and Wildlife Service at the Desert National Wildlife Range cooperated with the AIP in the collection of hock joint samples from Desert Bighorn sheep collected during the fall and winter special hunts. The ^{90}Sr results from 23 hock joints collected in December of 1968 and January of 1969, averaged 9.1 pCi/g of ash with a range of 6.3 to 13.0 pCi/g of ash. The ^{90}Sr results are down somewhat from that reported for 1967-1968 which averaged 9.6 pCi/g of ash. Only five samples had detectable amounts of ^{89}Sr and they ranged from 2.4 to 6.7 pCi/g of ash with an average of 4.0 pCi/g of ash.

Table 5. Summary of Analytical Results - NTS Mule Deer - 1969

Tissue	^{40}K g/kg	^{89}Sr pCi/g ash	^{90}Sr pCi/g ash	^{106}Ru pCi/g	^{131}I pCi/kg	^{137}Cs pCi/kg	^{144}Ce pCi/g
Abomasum Contents	4.3(5)* 1.7-5.9	NA	NA	2.0(2)[1] 1.8-2.2	All samples <250	1000(1)[2] ±100	2.2(2)[1] 1.9-2.5
Abomasum Tissue	4.2(4) 2.9-4.8	NA	NA	All samples <1.3	All samples <250	All samples <200	All samples <1.3
Bone Hock		3.9(1)[3] ±2.0	6.8(4) 1.6-14.5				
Liver	3.0(5) 2.2-3.8	NA	NA		All samples <250	All samples <200	All samples <1.3
Lung	1.6(4) 1.3-2.1	NA	NA	1.5(1)[3] 7.0	All samples <250	All samples <200	All samples <1.3
Muscle	3.4(5) 2.7-3.6	NA	NA	All samples <1.3	All samples <250	All samples <200	All samples <1.3
Rumen Content	2.6(5) 2.1-4.1	NA	NA	1.4(1)[3] 0.5	All samples <250	All samples <200	1.7(2)[1] 1.6-1.8
Thyroid pCi/g	All samples <MDL	NA	NA	All samples <1.3	5.1(1)[3] 2.3	All samples <0.2	All samples <1.3

Remarks:
*1st number is average. Number in parenthesis is number of samples above MDL. Other samples collected were below MDL or had insufficient activity for analysis. Third set of numbers is range.

[1]Positive results reported only in the May and July deer. [2]Positive results reported only in the July deer.

[3]Positive results reported only in the May deer.

NA = Not analyzed.

The AIP veterinarian also performs necropsies of bighorn sheep dying in the wild or in the pens at the Corn Creek Station. There were four necropsies performed in 1969 (see Appendix I). Analytical results of the tissues collected from these animals were below the MDL in all cases.

Special Studies

Special deer and beef collections were made for the Schooner and Rulison events. The results of these studies will be published as special reports. All of the Rulison background samples were below the MDL.

AIP personnel cooperated with Nevada Fish and Game personnel on two wildlife transplant projects. Veterinary support was provided during the capture of Desert Bighorn sheep from the Boulder Mountains for transplant to the Hawthorne area. Several surveys of NTS chukar partridge populations were made in order to determine if a capture and transplant program would be feasible. Weather conditions prevented sufficient concentrations of the birds for successful capture, but another attempt will be made in 1970.

PUBLIC RELATIONS

"Big Sam", a fistulated steer, was exhibited at the International Cattleman's Exposition held in Las Vegas, Nevada during December. This exhibit produced much interest and comment from the public and allowed us to inform people of the AIP objectives and of our results.

In June, AIP personnel assisted the Colvins of Goldfield in removing 25 Bar-forty beef animals from Area 20. This was done at the request of the AEC. Blood and fecal samples were collected and photographic documentation of the cows' conditions was made. E-500-B readings taken on the animals' feet and backs were background.

In November, AIP personnel also assisted John Mosier in removing his beef animals from the Bald Mountain area of the Bombing and Gunnery Range.

The AIP veterinarian served as project veterinarian for the Rulison event and informed the professional and farm organizational leaders of the progress of the event.

CLAIMS

The AIP veterinarian spent much of his time while at Rulison at a deer hunters camp near the Ground Zero. This was done to limit the inconvenience caused the hunters to a bare minimum and consequently reduced their claims.

No livestock damage claims were received as the result of testing activities in either Nevada or Colorado.

Rabies investigations were made on two bats, a fox, and a ring-tailed cat which were collected on the NTS. No biting incidences were reported in connection with these animals and gross observation failed to indicate rabies, so no further action was taken.

REFERENCES

1. Smith, D. D. SWRHL-80r "Management History of the AEC Beef Herd - 1 June 1964 - 1 June 1969." (March 1970)

2. Johns, F. B. SWRHL-11r "Handbook of Radiochemical Analytical Methods. (February 1970)

APPENDIX I. Gross and Microscopic Pathology* Found in Necropsied Animals.

Bovine

BOV-1-NTS-69. No gross lesions observed.

Histopathology Report:

Sarcosporidia are present

BOV-2-NTS-69. No gross lesions observed.

Histopathology Report:

Kidney. A few tubules contain slightly basophilic granular with fibrillar casts. There is no surrounding reaction.

Lung. A mild excess of perivascular and peribronchial eosinophils is seen.

Heart. Sarcocystis are present.

BOV-3-NTS-69. No gross lesions observed.

Histopathology Report:

Kidney. A few small foci of interstitial nephritis.

BOV-4-NTS-69. No gross lesions observed.

Histopathology Report:

Kidney. A tiny focus of interstitial nephritis.

BOV-5-NTS-69. No gross lesions observed.

Histopathology Report:

Lung. A few alveoli contain proteinaceous material and septal cells. The alveolar septae are mildly thickened. There are small peribronchial accumulation of lymphoid cells.

BOV-6-NTS-69. Low grade metritis both horns of uterus.

Histopathology Report:

Kidney. A small focus of round cells is in the interstitium at the cortico-medullary junction.

*As reported by Dr. James N. Shively, Division of Biological Effects, Bureau of Radiological Health, 12720 Twinbrook Parkway, Rockville, Maryland, 20852.

APPENDIX I. Gross and Microscopic Pathology Found in Necropsied Animals cont'd.

Bovine

BOV-7-NTS-69. No gross lesions observed.
Histopathology Report:
Kidney. Mild interstitial nephritis.
Muscles. Sarcosporidiosis.
Testes. A few small foci of subacute orchitis.

BOV-8-NTS-69. No gross lesions observed.
Histopathology Report:
Kidney. Mild, active interstitial nephritis.
Lungs. A focus in which the interalveolar septae are thickened.
Muscles. Sarcosporidiosis.

BOV-9-NTS-69. No gross lesions observed.
Histopathology Report:
Significant changes not seen.

BOV-10-NTS-69. No gross lesions observed.
Histopathology Report:
Significant changes not seen.

BOV-11-NTS-69. No gross lesions observed.
Histopathology Report:
Lung. Some lobules have edema and hemorrhage.

BOV-12-NTS-69. No gross lesions observed.
Histopathology Report:
Kidney. A small focus of interstitial nephritis.

Deer

MD-2-NTS-69. No gross lesions observed. No significant changes found during histopathological examination.

APPENDIX I. Gross and Microscopic Pathology Found in Necropsied Animals cont'd.

Deer

MD-3-NTS-69. There is a tumor above the left eye. Several isolated warts found on neck and right face of the animal. The warts are black and very rough, ranging from 1 cm to 3 cm in diameter. They are attached to the epidermal area by a narrow stalk. In several areas of the neck there are three or four of the larger warts grouped in one large mass. The large areas have a diameter of up to 6 cm. When the lesion above the eye was incised it consisted of solid, glistening white mass without an internal structure. There are no involutions into the center of the structure. The warts on the neck have the same color and appearance with the exception that the external surface is involuted into the center of the wart.

Histopathology Report:

The tumors are fibromas. Sarcocystis is present.

MD-4-NTS-69. Animal died as a result of vehicular collision. Suffered multiple traumatic injuries which included fractured left leg, severe contusions and abrasions, and massive internal hemorrhage.

Histopathology Report:

Kidney. Mild interstitial nephritis and glomerulosclerosis.

Muscles. Sarcosporidiosis.

MD-5-NTS-69. Animal died as a result of vehicular collision.and suffered extensive traumatic injuries. These included multiple fractures of the right fore leg, left rear leg, and left rib cage. The lungs were punctured and the liver was lacerated.

Histopathology Report: samples were not collected.

MD-6-NTS-69. Animal died as a result of vehicular collision. Suffered fractured skull and fragmentation of liver.

Histopathology Report:

Spleen: Congested and had foci of hemorrhage.

APPENDIX I. Gross and Microscopic Pathology Found in Necropsied Animals cont'd.

Desert Bighorn Sheep

DB-1-DGR-69. The urinary bladder contained about 15 cc of purulent material. The renal pelvis was edematous and contained small white precipitates of purulent material.

The apical lobes of the lungs had fibrous adhesions between their surface and the thoracic pleura. The apical lobes were congested and contained many small purulent areas. Both apical lobes were discolored green and showed necrosis.

The mitral valves had nodules along their borders.

Diagnosis: (1) Nephritis, (2) Pneumonitis

DB-2-DGR-69. Approximately 85% of the lung area appears to be involved with a pneumonic condition.

Fibrous adhesions between the lobes of the lung and the chest wall are seen extending from all lobes of the lung.

A pink normal appearing area, 6" long, 1-1/2" wide, and 2" deep, is seen on the dorsal, proximal border of each diaphragmatic lobe. These appear to be the only functioning areas of the lung.

Many small yellowish-white cheesy materials come from each nodule when incised.

All other areas of the lung are a grayish-brown color--possibly indicating an advance stage of hepatization.

Diagnosis: Bacterial pneumonia.

DB-3-DBR-69. As the rib cage was lifted, adhesions appeared on the apical lobes. All of the apical lobes, cardiac and intermediate lobes are hepatized and contain numerous abscesses (1-3 cm in diameter). Only functional tissue is on the dorsal posterior portions of the diaphragmatic lobes.

Diagnosis: Death from pneumonia - probably caused by pasteurella.

APPENDIX I. Gross and Microscopic Pathology Found in Necropsied Animals cont'd.

Desert Bighorn Sheep

Histopathology Report: One section of lung contains abscesses and necrotic foci. There is an inflammatory cell infiltrate. Edema is present. Changes are not seen in another lung section. There is lymphoid hypoplasia of the spleen.

Diagnosis: Pneumonia, lobar.

DB-4-DBR-69. Not necropsied.

DB-5-DGR-69. Hemorrhagic areas were seen in the abomasum, scattered in the small upper intestine and large bowel. The area of the spiral portion was engorged with blood and there was hemorrhage into the intestinal lumen. The liver was pale yellow and smaller than normal size. The abdominal cavity contained a large amount of sero-sanguineous fluid.

The kidneys were very soft. The bladder was void of urine.

The pericardial sac contained an excessive amount of sero-sanguineous fluid. The spleen was soft and crepitus.

The omentum was thickened. Cultures of heart blood, pericardial fluid, and intestinal content were taken and sent to United Laboratories. Smears of intestinal contents were negative for coccidia.

Tenative diagnosis: Enterotoxemia.

Histopathology Report: There is a severe hemorrhagic enteritis and a mild pneumonitis. Lymphoid follicles in the spleen are hypoplastic. There is a focus suggestive of fibroplasia in the thyroid, but autolytic changes make evaluation equivocal.

Laboratory findings of clostridium perfringins substantiate diagnosis of enterotoxemia.